

Integrated Low Temperature CO₂ and H₂O Electrolysis

Completed Technology Project (2017 - 2018)



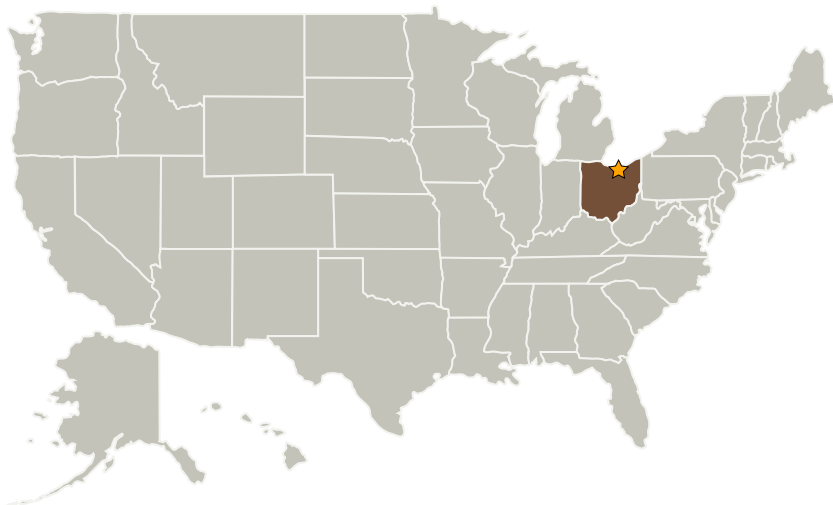
Project Introduction

Integrating the packaging of both the electrolysis of water and electrolysis of carbon dioxide into a compact dual electrolyzer package would be a highly useful and versatile product. Both of these electrolyzers could be started and run independently of each other, operate at mild temperature conditions, and quickly and repeatedly started and stopped. Because of the mild operating conditions, these electrolyzers should be capable of operating the thousands of hours needed for either a Lunar or Mars mission. The production of hydrogen, carbon monoxide, and oxygen from water and carbon dioxide will be essential to astronauts for the exploration of the moon and particularly Mars. Hydrogen and carbon monoxide can be used as fuels, as reducing agents to extract oxygen regolith metal oxides, and as precursors to the production of methane, other alkanes, methanol, and other alcohols. The goal is to design, build, and test a dual water and carbon dioxide electrolyzers that are packaged together in a single compact, lightweight integrated package.

Anticipated Benefits

This technology's value is the potential to compactly integrate two different electrolyzers that convert CO₂ to CO and O₂, and also convert H₂O to H₂ and O₂. There are a variety of potential uses for CO and H₂ that could offer many new future NASA missions/possibilities. Unmanned missions using this technology could produce needed logistical resources prior to human arrival, and could be used to produce the propellant needed for their return.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

Project Transitions

October 2017: Project Start

 September 2018: Closed out

Closeout Summary: The outcome of this project was the completion of an inexpensive electrolyzer cell that could function as either a CO₂ electrolyzer or as a H₂O electrolyzer. The cell is envisioned to be used as part of a dual integrated CO₂ and H₂O electrolyzer that could perform both electrolyzer functions simultaneously yet independently of one another. The current maturity is TRL 3. To continue to mature this technology, the next step would be to complete the testing of the CO₂ and H₂O electrolyzers.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Center Innovation Fund: GRC CIF

Project Management

Program Director:

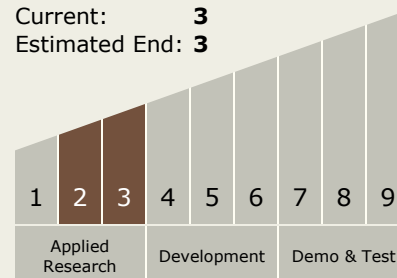
Michael R Lapointe

Program Managers:Kurt R Sacksteder
Gary A Horsham**Principal Investigator:**

Kenneth A Burke

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars